



Implements for Compact Tractors

Selection, Use, Maintenance and Safety

Table of Contents

Introduction	2
Aerator/dethatchers	2
Backhoe	2
Bale Spear	3
Bed Shaper	3
Blade-angle	4
Blade-box	4
Blade-front	5
Broom-rotary	5
Chipper-shredder	5
Cultivator	5
Dirt scoop	6
Disk bedder	6
Disk harrow	7
Generator	7
Grader blade	8
Harrow	8
Hay Implements	9
Loader	9
Log splitter	10
Middlebuster or lister	10
Mower-finishing	11
Mower-flail	11
Mower-mid-mount	12
Mower-reel	12
Mower-rotary cutter	13
Mower-sicklebar	14
Pallet forks	14
Plastic mulch layer	15
Post hole digger	17
Rake-landscape	17
Rake-lawn and pine straw	17
Rotary tiller	18
Sprayer	18
Spreader	19
Stump grinder	19
Subsoiler	20

Introduction Compact utility tractors are popular with farmers, landscape contractors and rural landowners. In fact, compact tractors are by far the best-selling tractor category. These small tractors are virtually useless by themselves, but they are versatile when equipped with the proper implements and attachments. A separate publication discussed the selection and use of compact tractors. This publication discusses the selection of suitable implements for use with compact tractors.

Not every contractor, farmer or rural homeowner will need all of these implements, but a select few of them can make any tractor more versatile.

Compact tractor implements can be classified several ways such as agricultural or landscape; tillage, maintenance or materials handling; front, mid or rear; etc., but these categories are sometimes confusing and overlapping. Implements in this publication are listed alphabetically.

Aerator/dethatchers Turf aerators (Figure 1) are used to cut turfgrass tillers and cut or puncture the soil surface. Some are designed to puncture the thatch layer and bring soil cores up on top of the thatch to aid in thatch decomposition.

Dethatchers are similar machines, but generally use spring tines to rake up thatch rather than slicing or puncturing the thatch and soil. Some machines have two kinds of tines to perform both operations. The overall purpose of these machines is to reduce thatch in turfgrass.



Figure 1. Turf aerator on compact tractor. (Photo from Deere and Company)

Aerators and dethatchers work well on compact tractors. They can be either 3-point mounted or pull-type. If using the 3-point type, you must be careful not to turn with the implement on the ground. Most aerators have some provision for adding weight to the machine, and extra weight is often needed for adequate soil penetration.

Several types of aerator tines are available. Some are flat blades that slice the soil. Others are solid round tines that puncture the soil. The best tines are hollow and bring up cores of soil from the holes rather than just pushing holes into the soil (and thus compacting the soil around the holes). When using any of these dethatchers, the holes should be refilled with porous material to hold them open. This can be done by topdressing with a thin layer of sand or by using a harrow or drag to break up the cores and sprinkle the loosened material back into the core holes – and into the thatch layer.

When a dethatcher is used, the thatch that is loosened should be raked up for disposal. Massive amounts of thatch are loosened by dethatching.

Of all the methods of thatch control discussed above, using a core aerator to remove cores and then breaking up the cores and scattering the material in the thatch layer and back in the holes is the most effective at breaking down and controlling thatch.

Backhoe A backhoe is one of the most expensive attachments, but they are fairly popular. Backhoes (Figure 2) mount on the rear of a compact tractor but often do not use the 3-point hitch, or at least not the standard upper arm. They are usually rigidly mounted on the rear of the tractor. Because they require a high flow rate of hydraulic oil, they typically have their own hydraulic pump that mounts on the tractor PTO. Backhoes have four primary hydraulic functions (swing, inner boom, outer boom and bucket curl) plus hydraulic actuation of the stabilizers. In purchasing a backhoe, you will have two choices in controls: two lever and four lever (plus two levers for the stabilizers). Older operators who have used four-lever controls in the past may prefer that style, but the newer two-lever designs are generally easier to learn to use and becoming popular.



Figure 2. Backhoe for compact tractor. (Photo from BushHog)

Backhoes for compact tractors are much lighter and lower in capacity than dedicated industrial-quality tractor loader/backhoes. Some companies make small dedicated tractor loader/backhoes similar in size to compact tractors; even these are considerably heavier duty than add-on compact tractor backhoes. The smallest full-size industrial tractor loader/backhoes are rated for a 13- to 14-foot digging depth. Most add-on backhoes are rated for digging depths in the 6- to 10-foot range, with correspondingly lower digging forces available.

Different buckets are available for backhoes. You can buy narrow buckets for trenching or wide buckets for general digging. Very wide, smooth buckets are available for ditch cleaning. Other accessories to increase the versatility of your backhoe are also available.

Operating a backhoe requires considerably more skill and experience than operating most tractor implements. Mounting and removing a backhoe is much more difficult and time consuming than for most other implements. Be sure you really need a backhoe before committing to the expense and effort. They can be handy but require a major investment of time and money.

If you do have a backhoe, it is important to protect your investment. First, be sure to lubricate all grease fittings on the recommended schedule. If the backhoe is not kept lubricated, the pins and/or bushings will wear and the whole machine will be loose and wobbly. Replacing pins and bushings can be expensive. Second, it is important to protect the seven hydraulic cylinder rods from corrosion. If you park a backhoe outside in the weather with any of the cylinder rods extended, pit corrosion will occur on the rods. The pits will then ruin the hydraulic seals the next time you try to use the machine. Frequent operation will minimize this problem. Ideally, a backhoe should be stored inside. If that is not possible, you should smear a layer of heavy grease over any exposed cylinder rods before storage. Storage inside away from sunlight will also help preserve the hoses.

Safety is always a concern. Because of the high hydraulic pressures associated with backhoes, hydraulic hose leaks can inject oil under the skin. Furthermore, it is all too easy to tip a tractor over when swinging a backhoe – especially if working on a slope. If possible, you should be under the ROPS and secured with a seatbelt. Be careful to keep any bystanders away while working. A swinging backhoe boom can injure or kill someone. Before digging, have all underground utilities located and then stay several feet away from them. Also, watch out for overhead wires.

Bale spear If you have to handle large round hay bales, a bale spear (Figure 3) is essential. You can put a bale spear on a front-end loader or on a 3-point hitch. But, remember that large round bales can weigh from 500 to 1,500 pounds. If you use a bale spear on a front-end loader on a compact tractor, you will need counterweight on the rear of the tractor; a 3-point hitch bale spear can provide this. Be sure to pick up the rear bale first and drop it off last. If you use only a 3-point hitch bale spear, you will need front weights on the tractor.

Hauling bales on a compact tractor is a challenge and requires caution. A bale spear on the back will make a small tractor difficult to handle and can block visibility to the rear. Extra care is needed when using a bale spear on a front-end loader. Keep the load as low as possible, and drive slowly. If you must lift the load up high, be careful not to let the spear roll back. The bale could then roll down the loader arms and crush the driver. Always wear your seatbelt when hauling bales in case the tractor overturns.



Figure 3. Bale spear for 3-point hitch on compact tractor. (Photo from Howse Implement Company)

Bed shaper If you are using a compact tractor for farming or working a large garden, a bed shaper (Figure 4) is a useful implement. Most row crops in the Deep South, including garden crops, are grown on beds. Shaping the beds with a bed shaper helps to prepare a good, firm seedbed for planting or transplanting. A bed shaper will crush the clods while firming and smoothing the soil. A planter will run much better on a shaped bed.



Figure 4. Bed shaper for compact tractor. (Photo from Buckeye Tractor Company)

It is important to select a bed shaper that has sides tapering in from front to rear so that the sides of the beds are compacted somewhat. It is also important to adjust the tractor 3-point hitch so that the rear of the bed shaper is a little lower than the front. This will cause the shaper to compact and firm the bed top. Additional weight on the shaper may be necessary, but often it is adequate merely to allow some soil to spill over onto the top of the shaper pan; the weight of the soil then helps firm the bed.

In some soils, especially light sands, it is possible to form a shaped bed directly from flat ground. Normally, it is necessary to lay out rough beds with a disk bedder or middlebuster, then knock the beds down and shape them with a bed shaper.

A pan-type bed shaper must carry a wave of soil in front of it to build firm, full beds. Without a wave of soil, you will not form a complete bed or a firm bed. The need to maintain this wave of soil makes a bed shaper challenging to operate. The driver will probably have to adjust the height of the 3-point hitch frequently to maintain the soil wave. You cannot merely drop the bed shaper and run. Using the draft control on the tractor rather than the position control will help, but it usually is not sufficient. The wave of soil causes a problem at the ends of the field. When you lift the shaper at the end of the row, the wave of soil from the field is deposited on the headland. Careful driving can spread the soil and avoid a pile, but you are still moving soil from the field to the headland. A spool shaper can avoid this problem, but spool shapers are generally not commercially available. Pan-type shapers are available from several sources.

Some larger commercial bed shapers have a plastic lining to reduce soil buildup under the shaper pan. This is helpful in some soils, but is not necessary in sandy soils. Operating at the correct soil moisture helps prevent buildup under the shaper. The soil should be dry enough to avoid stickiness, but still have enough moisture to allow firming into a shaped bed. If the soil

sticks to the shaper, it is too wet; if the beds collapse behind the shaper, the soil is too dry.

Blade – angle One of the handiest implements you can put on a compact tractor is an angle blade (Figure 5). Of the several types of blades available, an angle blade is probably the most versatile. It can be used for leveling, moving small amounts of soil, cutting shallow ditches and back-dragging. Since it mounts to the 3-point hitch, it is easy to mount and remove.



Figure 5. Angle blade for compact tractor. (Photo from Monroe Tufline)

The back-dragging function might be its most important use for homeowners. Back-dragging means that the blade is turned 180 degrees so that the blade is dragged backward. In that mode, the blade can be used to drag and level a gravel road or driveway with little effort. A blade can be used in the forward direction to level gravel, but much more operator skill is required than when back-dragging.

Angle blades are available in several configurations. The cheapest blades merely allow the blade to be rotated in one plane around a vertical axis. Better blades also allow rotation around a horizontal axis so that one side of the blade can be lowered. A further refinement on some blades allows the blade to be offset to one side. This can be accomplished by sliding the blade sideways or, on some models, by swinging the frame arm to the side. Operating the blade offset to the side may not work well with compact tractors since a small tractor may not be heavy enough to handle an offset blade. This offset feature tends to be found mainly on larger blades.

The adjustments on angle blades can be accomplished several ways. Some models have a series of holes and pins to hold the blade in the rotated positions; others have a lever that locks into notches. Some use a turnbuckle or other adjustable-length arm for some of the adjustments. On those models, it is possible to substitute a hydraulic cylinder for the turnbuckle to allow power adjustment from the tractor seat. This feature is more commonly found on larger blades than those used on compact tractors.

Another feature found on some larger blades is a gage wheel on the rear. This makes the blade easier to control, allowing the tractor and blade to act more like a road grader. These units normally use a hydraulic cylinder to control the gage wheel.

Angle blades are available in a wide range of quality and strength levels as well as sizes ranging from about 4 feet on up. The widths most commonly used with compact tractors are 5 to 7 feet. If the blade is

much wider, a compact tractor may not have the power and weight to handle it, but if the blade is narrower than the tractor wheel width, it is hard to do a good job. A 6-foot blade is a good compromise on most compact tractors. Some cheap blades are light and easily damaged (bent) if you hit a rock, root or stump. You need a blade heavy enough to stall or stop the tractor before the blade or frame bends.

Another feature to watch for is overall length. Some models put the blade a long way behind the tractor. The closer the blade is to the tractor tires, the easier it is to control depth. This factor makes a tremendous difference in ease of use. The only exception is a blade with a gage wheel; in that case, extra length is an advantage.

An angle blade is not a major investment, but it is useful. Be sure to pay enough to get one that is strong. It is better to sacrifice some size and features than to get one that is so light it bends when used.

Blade – box A box blade (Figure 6) is useful around building and landscape construction sites or anywhere loose material such as soil or gravel needs to be moved short distances. Box blades have blades on the front and back side of the rear of the box, thus they can push or pull soil; however, they can only constrain soil in the box when moving forward. Most box blades have ripper teeth on the front toolbar that can be adjusted for depth or lifted out of the way. The teeth allow you to break up hard soil before scraping. On some heavy-duty box blades, the teeth can be rotated up and down with a hydraulic cylinder, but, on most box blades sold for compact tractors, the teeth are manually adjusted with mechanical latches.



Figure 6. Box blade for compact tractor. (Photo from Monroe Tufline)

With a box blade you can scrape up a pile of soil (or gravel, sand, etc.) and drag it a short distance, then spread it or dump it. You can also operate the blade in reverse to smooth or level the surface.

Box blade widths range from 4 feet on up. Most box blades for use with compact tractors are 5 to 6 feet wide. As with an angle blade, the implement should be at least as wide as the tractor tires for practical operation, but a blade that is too wide will overload the tractor.

Quality is less of a problem with box blades than with angle blades, but select one that is heavy enough to stall the tractor before bending. The ripper teeth tend to be the most easily damaged part of the implement. Even though the box blade is heavy enough to handle impacts with objects like stumps and roots, you should use caution since these impacts can damage the 3-point hitch or other components on the tractor.

Blade – front Blades can also be mounted on the front of compact tractors (Figure 7). Front blades are much less common than rear blades, but they offer an advantage in visibility. Front blades are more difficult and time consuming to install since they do not fit on a 3-point hitch. Most front blades can be angled from side to side; some can be angled vertically, but that feature is much less common. Some models can be angled hydraulically.

Raising and lowering the front blade is done in different ways. Some models use a hydraulic cylinder; others are linked to the 3-point hitch. The models linked to the 3-point hitch avoid the need for remote hydraulics on the tractor but prevent other uses of the 3-point hitch when the blade is installed.

A front blade cannot be used for back-dragging unless the tractor is operated in reverse. Probably the best use for a front blade is clearing snow – not a major problem in Louisiana.

In addition to dedicated front blades, it is possible to buy front blades that fit on front-end loaders in place of the bucket.

Broom – rotary A rotary broom can be attached to the front of a tractor similar to the way a front blade is attached (Figure 8). These powered rotary brooms are useful for cleaning hard surfaces – roads, driveways, parking lots. They are often used in the North for removing light snow. This implement would be of little value to most farmers or homeowners, but it might be of value to a contractor. Many widths and brush diameters are available. The drive can be mechanical or hydraulic. The broom is usually run at an angle so material is swept to the side.



Figure 7. Front blade on compact tractor. (Photo from Kubota)



Figure 8. Rotary broom on compact tractor. (Photo from Deere and Company)

Chipper/shredder Small engine-driven chipper/shredders are popular with homeowners. Many commercial maintenance contractors use large engine-driven chippers towed by trucks. There is a category in the middle that works well with compact tractors. Many companies make mid-sized PTO-powered chipper/shredders (Figure 9) that mount on the 3-point hitch of a

tractor. These machines are readily portable, easy to use and have high capacity since they can use the tractor's full PTO power instead of a small engine.

Some of these PTO chippers can handle limbs 6 inches or more in diameter. Some models are strictly chippers; others can also shred leaves and clippings. The cutting mode differs from model to model.

The machine should be lowered to the ground before use, and the 3-point hitch attachment should be secure before engaging the PTO.

Any chipper or shredder is dangerous, and the relatively high power input available from a tractor PTO makes these machines even more dangerous than small engine-driven homeowner units. The two primary dangers are thrown objects (from the input or the outlet) and being pulled into the cutting area. Exposed drive components, including the PTO shaft, are another hazard. When operating a chipper/shredder, you should wear full eye protection (goggles or full face shield), hearing protection and gloves. Stay out of the line of throw from both the intake and outlet. Do not wear loose clothing. Be careful when feeding material into the hopper. Do not reach into the hopper. Do not hold onto limbs while feeding. Throw them in and let go of them before the machine grabs them. Do not exceed the capacity of your machine.

A PTO chipper should have a safety bar at the intake that allows an operator to stop or reverse the feeding mechanism.

Some chipper/shredders are designed to throw the chips onto the ground; others have a discharge chute that can direct the chips into a truck or trailer.

Cultivator A row-crop cultivator (Figure 10) can be used with a compact tractor to help control weeds in a large garden or a small commercial vegetable operation. Mechanical weed control is ecologically sound and inexpensive compared with herbicides. Unlike herbicides, mechanical weed control is not crop-specific.

Cultivators are available in many configurations including rigid shank, spring tine, sweep, point, rolling and indi-



Figure 9. PTO chipper on compact tractor. (Photo from Vermeer Manufacturing Company)



Figure 10. 1-row row-crop cultivator for compact tractor. (Photo from Howse Implement Company)

vidual floating gangs; however, the inexpensive cultivators most frequently sold for use with compact tractors tend to have several spring tines with points rather than sweeps. This type of cultivator is considerably less effective than the individual floating gangs with sweeps that are normally used on multi-row cultivators. Single-row cultivators with individual floating gangs and sweeps can be configured from available components, but they will cost much more than the readily-available spring tine and point cultivators.

For commercial operations, consider cone guide wheels. These, operating on shaped beds following precision planting, allow much more precise cultivation with less effort. Cone guide wheels are hard to justify for a garden.

Dirt scoop A dirt scoop (Figure 11) is a handy attachment for small tractors. It will allow you to dig, move and dump small quantities of soil, gravel, sand or other materials much easier than you can do with a shovel and wheelbarrow and much less expensively than with a front-end loader on your tractor. A dirt scoop may be called by other names such as a rear bucket, slip bucket or slip scoop. It mounts on the 3-point hitch of a tractor. It is raised and lowered by the tractor, and usually has a manual dump, triggered by pulling a rope. The scoop or bucket can be reversed (by hitching to either end), thus allowing you to dig in either forward or reverse, depending on the requirements of a given project. The normal mode of action is to scoop up a load of material in the bucket, haul it wherever needed and dump it.



Figure 11. Dirt scoop on compact tractor.

The most important advantage of a dirt scoop is low cost. One can be purchased for less than \$300. It provides a low-cost mechanized alternative to a shovel and wheelbarrow. It is useful for small digging projects around a homestead and for small grounds maintenance jobs. It is certainly not as versatile as a front-end loader, nor does it match the capacity of a front-end loader, but it costs much less. Because it mounts on the rear of the tractor, good traction is available for digging. A dirt scoop cannot handle as large a load as a front-end loader. Because a dirt scoop is behind the tractor, visibility may be limited and awkward.

A simple dirt scoop is a useful implement for your compact tractor and performs some of the functions of a front-end loader, although not as efficiently.

Disk bedder Most gardens and row crops in the Deep South are planted on raised beds. In most cases, the best way to lay out beds is with a disk bedder (Figure 12), also locally called a “hipper.” Disk bedders may have two or three blades on each side; the blades may be the same or different sizes, depending on model.

A disk bedder can be used for primary tillage (operated on ground that has not been previously worked with another implement) or secondary tillage (operated after some other operation such as plowing or disking). A disk bedder is an aggressive tool capable of slicing through plants or plant residue.



Figure 12. One-row disk bedder on compact tractor. (Photo from Buckeye Tractor Company)

Notched blades enhance the ability of the tool to slice through plants and plant residue and make the implement more aggressive.

Some commercial vegetable growers bed up their fields in the off season and plant a cover crop such as peas or soybeans on the beds, then come in before planting their main crop and split the beds open with a disk bedder, burying the cover crop in the old middles under the new beds.

The primary challenge in using a disk bedder is getting straight beds at the proper spacings. With larger tractors, multi-row bedders ensure proper spacing between beds; with a one-row bedder, it is all up to the driver. In some cases, it is best to make one light pass to lay out the beds, then a second, deeper pass to attain the desired bed height.

Hitching, unhitching and storage of disk bedders is a problem since they will not stand up by themselves when unhitched. Simply leaning the implement against a post or tree is not safe; it could fall on someone. If you must lean an implement like this against a tree or post, tie or chain it to the tree or post so it can't fall over. It is possible to build a simple frame to support a disk bedder (or any similar implement) (Figure 13). A frame like this is much safer and makes hitching and unhitching much easier.



Figure 13. Homemade frame to support disk bedder or similar implement.

Disk harrow Although moldboard plows are used for primary tillage in more northern areas, a disk harrow (Figure 14) is frequently the primary tillage tool of choice in the South. Disk harrows are available in several configurations: single, tandem and offset. The most common disk harrow for use with a compact tractor is the tandem disk that has four gangs as shown in Figure 14. The front gangs throw soil out, and the rear gangs move it back toward the center. The angle of the individual gangs can be changed to make the disk more aggressive; the greater the angle, the more aggressive the disk.



Figure 14. Disk harrows for compact tractors. (Photo from Monroe Tufline)

Disk harrows depend on weight to penetrate the soil, thus many disks have some provision for extra weight to be added. This is particularly important on light, inexpensive disks for compact tractors. Widths of 4 to 6 feet are common with compact tractors. Blade diameter and spacing influence cutting depth and quality of tillage. Spacing the individual blades closer together provides finer tilth. Bigger blades can cut deeper. Many disks have notched blades. The notches cut plant residue better and also act like gears, engaging the soil to keep the blades turning rather than slipping.

A disk harrow has a tendency to leave a furrow at the edge of the pattern where the outer rear blade digs soil to throw inward. Some larger agricultural disks have an additional small disk on the outside of each rear gang to fill this furrow; this feature is normally not found on small disks. The operator has to correct for the periodic furrows with another tillage tool such as a spike harrow or drag, or live with the furrows.

If a disk harrow is used as the only tillage tool, multiple passes will be necessary in most cases to get decent tilth and incorporation of plant residue. Making additional passes at various angles to the first pass is most effective.

Two primary wear areas on disks are the blades and the bearings. Bearings on larger ag disks can generally be lubricated, but most small disks use sealed bearings that cannot be regreased. Blade wear is a factor of both use and soil type. If you do disassemble a disk gang to replace bearings and/or blades, you must tighten it back up correctly. The normal rule is to use a cheater bar on your wrenches and get the axle nut as tight as you can get it; then give it another turn.

A small disk can be useful for preparing a garden site, working small farm fields, preparing wildlife food plots and loosening soil on landscape construction sites.

It is an inexpensive and fairly high speed tillage tool. It can be used for either primary or secondary tillage. Small disks are available from many manufacturers.

Generator Most folks in the Gulf Coast area understand the value of home generators to keep power in their homes when hurricanes strike. Further from the coast, home generators are useful when ice or snow knocks down power lines. Generators are also handy for projects requiring the use of electric tools when away from an electric outlet. Although most people opt for small engine-driven generators, there are some real advantages to a generator that connects to a tractor power-take-off (PTO).

Advantages of a PTO generator (Figure 15) compared with an engine-powered generator are:

- No additional engine to maintain
- Since you don't have to buy an engine, you can get more capacity (kilowatts) for your money.
- No need to start the generator regularly to keep it ready to run – a PTO generator can sit unused for many months and still be ready to go.
- Assuming you use your tractor regularly, it is more likely to start and run when you need it than a small engine on a generator.

One horsepower equals 0.75 kilowatt (kw), so you can multiply your tractor's PTO hp by 0.75 and get an idea of the maximum size of generator your tractor can handle.

Because the generator is not 100% efficient, you will probably not be able to actually deliver quite that much power. On the other hand, you can always buy a generator that is rated a little too large for your tractor,



Figure 15. PTO generator on compact tractor.

and just not connect up a full electric load. If you do overload the equipment, PTO rpm will drop, causing the frequency of the current to drop and the tractor may stall. Depending on size of the tractor and generator, the system may or may not allow you to run the whole house. Typically, you will be able to run lights and appliances, but not an air conditioner or heat pump.

It is absolutely essential that you connect your generator to your house in a safe and approved manner. Most small engine-driven generators just have outlets to plug in extension cords so that you can disconnect your appliances or whatever from the house circuit and connect them directly to the generator. PTO generators may also have some outlets for extension cords, but typically have one big outlet for a large 240-volt plug that can be used to connect to the house service entrance.

NEVER CONNECT TO A HOME SERVICE ENTRANCE WITHOUT GOING THROUGH AN APPROVED DOUBLE-POLE DOUBLE-THROW TRANSFER SWITCH! This switch (Figure 16) will completely disconnect the home service entrance box from the utility's power lines when the generator is connected and vice versa. This is essential to avoid your generator feeding current back into the utility line and risking killing a utility lineman who is repairing the line. It also prevents utility power feeding back into your generator when the line power is restored. Consult your utility company and use only an approved transfer switch and have the installation approved by the utility company. People's lives depend on it! You can then wire up a cable from your transfer switch to connect to the generator (Figure 17).



Figure 16. Transfer switch for safe switching between line power and

Running computers and other sophisticated electronic equipment from any generator is not recommended since the power may not be stable or "clean" enough. Don't take the chance of ruining your computer or other electronics.

Maintenance on a PTO generator is pretty simple: keep it sheltered and out of the weather, be sure the tires are aired up (unless permanently mounted on a pad or mounted on a 3-point hitch), and grease any fittings on the powershaft or other drive components.



Figure 17. Large cord and plug to connect house transfer switch to PTO generator.

New PTO generators can be expensive, but generally cost much less per kw than engine-powered generators. PTO generators are a little harder to find but still available from tractor dealers and some mail-order supply companies. Some farmers have PTO generators to provide backup power for poultry houses, dairy barns and greenhouses. It is sometimes possible to buy a used PTO generator from a farmer for considerably less than the cost of an equivalent new one. If the generator has been sheltered and cared for, it should function as well as a new one for backup purposes. Whether new or used, it is easier and less expensive to buy a generator when the weather is good rather than

waiting until a storm hits and generators are in demand.

PTO generators can provide a lot of peace of mind. They are far less trouble than engine-driven generators – if you already have a compact tractor. They can offer more kw for your investment than an engine-driven generator.

Grader blade A relatively new implement for compact tractors that is becoming increasingly popular is a grader blade, sometimes called a road scraper (Figure 18). Models from different companies offer somewhat different configurations, but generally have two or more angled blades mounted rigidly in a frame. They mount on a tractor 3-point hitch. They are used to drag and level gravel or dirt roads and driveways. They are easier and faster to use than an angle blade or a box blade. They are generally available in widths from 5 to 7 feet. It is important that the 3-point hitch be properly adjusted to keep the implement level. There are no moving parts to replace. Like any blade, there are different quality levels available; it is worthwhile to get



Figure 18. Grader blade for a compact tractor. (Photo from Howse Implement Company)

one that is heavy enough that it won't bend in use. Although this is a fairly specialized implement, it can be useful if you have a lot of road or driveway to maintain.

Harrow Harrows are valuable implements for secondary tillage – smoothing and leveling soil and breaking up clods. They are useful for preparing both fields and landscape areas for planting and for spreading manure piles in pastures. Several types of harrows are available; they differ in aggressiveness and depth of tillage.

Spring-tooth harrows (Figure 19) are the most aggressive. The tines can be C-shaped tines as shown in Figure 19 or S-shaped ("Danish") tines that provide side-to-side vibration. The tines can be tipped with points or small sweeps. Sweeps do a better job of uprooting all weeds. The spring tines of either type

catch and then spring loose, thus vibrating and removing weeds. They also break up clods. Spring-tooth harrows are usually mounted on a 3-point hitch.



Figure 19. Spring-tooth harrow for compact tractor.

Spike-tooth harrows (Figure 20) are relatively rigid tools that are not as aggressive as spring-tooth harrows. Spike-tooth harrows are usually available in sections about 4 feet wide. They can be ganged on a bar as shown in Figure 20 to provide a wider working width. They can be pulled from the drawbar or mounted on a 3-point hitch. A drawbar hitch is less expensive, but it complicates transport. The angle of the teeth can be adjusted from vertical to angled back almost flat. The more vertical the teeth, the more aggressive the action.



Figure 20. Spike-tooth harrow for compact tractor. (Photo from

Chain harrows (Figure 21) are offered by several companies. They are popular for landscape use and are used in agriculture. They are flexible and do a good job of smoothing and leveling before sodding or seeding turfgrass. They are available in many widths and do not require a great deal of power. Most models are pulled from the drawbar. Some can be rolled up for storage or transport.



Figure 21. Chain harrow for compact tractor. (Photo from Kovar

Harrows are useful in farming and landscape operations as a final secondary tillage tool. They are generally inexpensive, easy to use and require minimal power to pull.

Hay implements Although compact tractors are small, they can be used to pull some smaller hay implements including mower/conditioners, rakes and balers. Hay equipment will not be covered in detail in this publication.

Most hay in the South is cut with disc mowers rather than sicklebar mowers because disc mowers handle fire ant mounds better. Most farmers have now gone to mower/conditioners rather than just mowers. The conditioners can either crush the stems between rubber rolls or crimp them between corrugated rolls – or both. Conditioning allows the hay to dry faster, reducing the likelihood of the crop being rained on before it is baled. Mower/conditioners can leave the hay in a swath or a windrow.

Hay rakes come in two functional styles: basket rakes and wheel rakes. Both types are considered side-delivery rakes and convey the hay to the side to form a windrow. Both types of rakes are ground driven.

There are also two types of balers that can be pulled with compact tractors. Small rectangular bales can be made by conventional balers and the power requirement is reasonable for a compact tractor. Compact tractors can also operate the smaller sizes of large round baler. A third type of baler, one that makes big square bales, generally requires a larger tractor.

Loader One of the most popular implements for compact tractors is a front-end loader (Figure 22). A loader will allow you to dig, move soil or other bulk products, carry bags and other bulky items, lift equipment (using a chain), move hay bales, lift pallets and even do light grading. Not all compact tractors are equipped with the necessary hydraulic connections for a loader, so be sure you check on hydraulics if adding a loader to an existing tractor. Some manufacturers now offer front-end loaders that are much easier to attach and remove (once initially mounted) than in the past, making it more practical to remove a loader when you don't need it. A loader for a compact tractor may cost \$2,000-\$3,000, depending on size and quality. In most cases, a loader made by the tractor manufacturer will cost more, but it should fit better and will be designed specifically for your tractor model.



Figure 22. Front-end loader on compact tractor. (Photo from Farmhand)

Most loaders use a single-lever control instead of the two-lever controls of the past. The fore-and-aft movement of the lever raises the loader and the side-to-side movement tilts the bucket.

Most front-end loaders are sold with just a material bucket, but there are many other options that can increase the versatility of a loader including pallet forks, manure forks, bale spears, blades and grapples. Some loaders and attachments conform to the quick-attach standard for skid-steer loaders so that skid-steer attachments can be used on those loaders.

Front-end loaders are popular, but expensive, options. Many people who buy a small tractor with a loader find that they seldom use the loader. The loader is a nuisance to leave on the tractor, reduces visibility and makes it more difficult to maneuver, but can be a hassle to remove – even with the new, faster mounting systems. If you really do need a loader, consider getting a compact tractor with front-wheel assist for both improved traction and increased front-axle load

capacity. If you are going to use a loader extensively, consider either a shuttle shift or a hydrostatic transmission to ease the frequent direction reversals.

Counterweight will be needed on the rear of the tractor to balance the front-end load. This can be accomplished several ways. Rear wheel weights and fluid in the rear tires will help, but more weight may be needed. If so, the weight can be added to the 3-point hitch either by just hitching to a heavy implement or by using a 3-point mounted weight box filled with sand, concrete, gravel, soil, etc. If a quick hitch is used, it is easy to hitch or unhitch from a weight box as needed.

There are several safety issues with front-end loaders. Never leave a tractor without lowering the loader completely to the ground. This is both a safety issue and an important step in protecting the loader hydraulic system. When the loader is left in a raised position, sunlight heating the hydraulic lines can build up pressures in the lines that are much higher than rated operating pressures, leading to possible hose rupture. When driving with a loader, keep the bucket as low as possible. This will make the unit more stable, reduce the risk of encountering overhead power lines and improve visibility. Be careful to keep the bucket level when lifting objects such as hay bales high to prevent them from rolling back down the loader arms onto the driver. Be careful not to raise the bucket high when on uneven ground because an overturn could occur. Be especially careful to keep your ROPS raised and wear your seatbelt when using a loader.

Log splitter Many people use log splitters to prepare firewood for stoves and fireplaces. Many small engine-driven log splitters are available, but if you own a compact tractor, a better choice might be a log splitter powered by your tractor's hydraulic system (Figure 23). This avoids the problem of maintaining another small engine and can provide better splitter performance.

Some tractor log splitters operate vertically and some horizontally. The horizontal type are generally better for splitting smaller logs, but the vertical type makes it easier to split large, heavy logs. Some machines can be used in either mode (Figure 23).

Splitting force is a factor of both hydraulic pressure and cylinder diameter. Because of the high pressure available on tractors, the cylinders may not need to be as large on tractor units as on units powered by a small engine. Operating speed is determined by hydraulic flow rate and cylinder size. The smaller the cylinder, the faster the cycle time. Thus, it is desirable to use the smallest cylinder that will



Figure 23. Log splitter for compact tractor. (Photo from Brave Products)

provide the necessary force; a cylinder larger than that will slow you down.

For safety reasons, a tractor-powered log splitter should have a separate hydraulic valve on the splitter itself and not depend on the tractor hydraulic lever. Using the tractor hydraulic lever to control the motion of the cylinder usually requires two people: one handling the log and one running the lever. It is dangerous to have the cylinder operated by someone other than the person holding and maneuvering the log. To use a separate control valve on the splitter, the tractor hydraulic lever must be held in the "on" position while using the splitter. Some tractor models have a lock position (intended for use with hydraulic motors); others require tying the lever in the "on" position with a rope or bungee cord. Either method can create a hazard if the tractor hydraulic lever is not released when the splitter is not in use.

The fact that a log splitter operates slowly tends to enhance safety; nevertheless, if a body part is caught by the splitter, it can be crushed or severed. There is also a danger of flying objects when a log suddenly splits and/or drops. Safety glasses are needed. Foot protection is essential when running a splitter – wear steel-toe boots. Gloves will help protect hands from splinters.

Middlebuster or lister A middlebuster or lister (Figure 24) is shaped like two moldboard plows joined together. It opens a furrow and throws soil in both directions. One middlebuster can be mounted on a toolbar (Figure 24) to make a furrow, or two middlebusters can be mounted on a toolbar to form beds.

A middlebuster is good for forming a furrow for planting crops such as potatoes. It is also useful for busting out existing beds. A common practice among vegetable growers is to plant crops such as cucumber or cantaloupe on every other bed; then when the crops start to run, the alternate beds are busted out to make wide beds.

A similar use for a middle buster is to plant a cover crop such as peas or beans on beds, then bust out the beds and bury the cover crop in the middles.

A middlebuster is generally harder to control than a disk bedder. It will tend to catch on roots, rocks or even hard clay and jerk the tractor to the side; a disk bedder will tend to ride over such obstacles. A middlebuster needs to be able to trip in some manner when it hits an immovable object. Most small, inexpensive middlebusters just have a pivot bolt and a second bolt in an open slot that allows the bottom to



Figure 24. Middlebuster for compact tractor. (Photo from Cimarron)

trip, but must be manually reset with a wrench. More expensive models have spring trips that reset without tools.

Mower – finishing Finishing mowers (Figure 25) are also called grooming mowers. Finishing mowers have decks that are virtually the same as the decks on mid-mount mowers. They typically have three blades. Height is controlled by four gage wheels (two wheels on cheap models). These mowers vary greatly in quality with corresponding price differences. This is a case where it is worthwhile to buy a high-quality mower with a heavy deck, four heavy gage wheels, heavy frame and heavy power transmission components. The better models use separate belts to drive the outer blades and eliminate the need for a back-side idler on the drive belt; this dramatically improves belt life. Finishing mowers can provide cut quality equal to mid-mount mowers. They work well for mowing open areas, but they are difficult to maneuver around trees or other obstacles. They are easily attached and removed. They are not designed to cut tall, weedy grass. They have multiple gage wheels and rollers that allow a relatively low cutting height with minimal scalping.



Figure 25. Heavy-duty finishing mower on compact tractor.

Some gage wheel heights are controlled by pins in a series of holes and some by moving bushings. By setting all four wheels to the same setting, you can control the height of cut. You then merely drop the 3-point hitch all the way down and let the mower ride on the gage wheels. Some cheaper finishing mowers have only two gage wheels, so the front of the deck must be carried by the tractor the same way a rotary cutter is carried, and must be adjusted the same way as a rotary cutter. To measure the height of cut for a finishing mower, park the tractor and mower deck on a smooth, level (preferably paved) surface, and measure the distance from the ground up to the cutting edge of the blades (*be sure the tractor engine is turned off*). This measurement should be the same for all blades.

It may come as a surprise to you that the deck should not be run level. With any rotary mower, it is desirable to set the front slightly lower so that the blade cuts at the front, and the rear of the blade does not recut the grass or drag on the grass. This will reduce the power requirement and provide a cleaner cut. This slight angle should be designed into your finishing mower so that all you have to do is set the front and rear gage wheels to the same position to achieve the correct

“nose down” position.

When you are running a finishing mower, the sway bars or chains on the 3-point hitch of the tractor should be reasonably tight to assure that the mower follows straight behind the tractor and doesn't sway. This is especially important when you have to back up.

A finishing mower must be able to pivot vertically about the lower link pins of the 3-point hitch to allow the mower deck to follow ground contours, yet it must have a limit on this flexing motion to allow the mower to be raised for transport. All finishing mowers employ some type of moving linkage on the upper hitch point to allow this, but improper adjustment can negate it. You must adjust the upper link of the 3-point hitch on your tractor to allow some flex of the mower deck, but still be able to lift the mower. This adjustment is somewhat subjective, but adjust the length of the upper link out enough that when you lift the 3-point hitch above the normal operating point, the rear gage wheels remain on the ground for a while as the front of the mower lifts, but the rear gage wheels eventually lift at least a foot off the ground when the 3-point hitch is completely raised.

A finishing mower must also be level from side to side. The easiest way to check this is to bend down behind the deck (with the PTO disengaged) and sight over the deck at the tractor rear axle. If the deck is not parallel with the tractor axle, you will need to adjust one of the lower 3-point hitch lift arms until it is parallel.

All of these steps are simple to do and take only a few minutes, but they contribute significantly to both the quality of cut and the longevity of your mower.

Safety is a consideration with any mower. If it can cut grass, it can cut hands and feet. All finishing mowers should be equipped with safety chains, front and rear. These chains substantially reduce, but don't eliminate, the hazard of thrown objects. Do not operate the machine within 200-300 feet of any bystanders. Before operating, pick up any rocks, trash or anything that could be thrown. Be sure blade bolts are tight so the blades can't come off. Avoid hitting any solid objects that could fracture a blade. Always avoid contact with the PTO shaft. The PTO should be turned off before you leave the tractor seat, and the mower rotation should be completely stopped before anyone approaches.

Mower – flail Flail mowers (Figure 26) are often used by highway mowing and park maintenance crews because they are somewhat less likely to throw objects. On a flail mower, the blades are free-swinging and rotate around a horizontal axis. The cut from a flail mower is



Figure 26. Flail mower on compact tractor.

distinctive and different from rotary mowers. The blades are often Y-shaped (or sometimes, half a Y), so the mown grass has a combed or ridged appearance. Some people like this effect; some do not. Control of cutting height may depend on the tractor 3-point hitch, although some models have an adjustable roller to control height.

Even though flail mowers are less likely to throw objects than a rotary mower, there is still a thrown objects hazard and caution is needed. Also, as with any mower, there are hazards from the PTO shaft and the moving blades.

Mower – mid-mount Mid-mount decks are popular on the smaller compact utility tractors and on subcompact tractors (Figure 27). They tend to be more difficult to remove than rear-mount mowers, so they are more popular on the smaller tractors used primarily for mowing. On some current models of tractor, it is now possible to leave a mid-mount mower in place while using a front loader or a rear-mounted implement such as a tiller; nevertheless, operating other implements with a mid-mount mower in place can compromise performance of the other implements, and it certainly reduces ground clearance. Mid-mount decks generally provide good maneuverability and allow close trimming. Mid-mount mowers on compact tractors are usually ground-carried (they ride on the ground when in use and are merely pulled along by the tractor, whereas mid-mount mowers on lawn and garden tractors are usually suspended from the tractor with the cutting height controlled by the suspension linkage). Cutting height adjustment is made by moving the gage wheels up or down.



Figure 27. Mid-mount mower deck on subcompact tractor.

Mid-mount mowers for lawn, garden and compact tractors typically have two or three blades and are designed for quality mowing of turfgrass. They are not designed to cut tall, weedy grass. They have multiple gage wheels and rollers that allow a relatively low cutting height with minimal scalping.

With a “ground following” deck, you set the height of cut by adjusting all four gage wheels to the same height setting. This might involve moving a pin at each wheel, or moving a stack of spacers at each wheel. Your operator’s manual will explain how to set your specific deck. To measure the height of cut, park the mower deck on a smooth, level (preferably paved) surface, lower the deck and measure the distance from the ground up to the cutting edge of the blades (*be sure the*

tractor engine is turned off). This measurement should be the same for all blades.

The deck should not be run level. With any rotary mower, it is desirable to set the front slightly lower so that the blade cuts at the front and the rear of the blade does not recut the grass or drag on the grass. This will reduce the power requirement and provide a cleaner cut. Your operator’s manual will tell you how to adjust your mower to achieve the correct “nose down” position.

A mower deck must also be level from side to side. You can check your deck by lowering it and measuring the height from the ground to the cutting edge of the blade on each side with the blades turned at a right angle to the direction of travel (*be sure the tractor engine is turned off*).

Most mid-mount decks have two or more anti-scalp rollers that must be adjusted for height of cut. These components should be adjusted so that they do not contact the ground when the deck is lowered to the preset cutting height and the mower is parked on level pavement. Your operator’s manual will give specific instructions on adjusting these components. Different manufacturers recommend different ground clearances, but $\frac{3}{4}$ inch is fairly typical. These components will then lift the mower deck when a high spot is encountered but have no effect on level ground. Furthermore, proper adjustment will reduce wear on the wheels and rollers since they will normally not be contacting the ground.

Adjusting a mid-mount mower is more complicated than some other types of mowers, but once it’s adjusted, you shouldn’t need to change the adjustments unless you change the cutting height. These adjustments will contribute significantly to both the quality of cut and the longevity of your mower.

Safety is always an issue with a rotary mower. It is important to keep the discharge chute in place to reduce thrown objects hazards. Never operate a mower when any bystanders are in the area. Disengage the mid-PTO and allow the mower to stop completely before dismounting. Do not operate the mower in the raised position.

Mower – reel Reel mowers are much less common than other mowers, but gang reel mowers (Figure 28) are available for compact tractors. Reel mowers are used primarily where a high cutting quality and low cutting height are required such as golf courses, athletic fields, parks and sod farms. Pull-type gang reel mowers can be ground driven or driven by a hydraulic motor on each unit. Reel mowers will not cut tall or tough grass and



Figure 28. Reel mower (Photo from Locke)

weeds, but they will do an excellent job of maintaining quality turf. If the height of the turf to be cut is not excessive, reel mowers give a very clean cut. The power requirement for reel mowers is relatively low, allowing a compact tractor to pull a fairly wide mower. The rollers on reel mowers give the turf the striped look common on sports fields. Reel mowers should be used only with tractors having turf tires; it does not make sense to go to the expense of a reel mower to attain high-quality turf and then drive on it with lugged tires. Pull-type gang reel mowers are best suited to open turf areas with few, if any, trees or other obstacles.

Reels are easily damaged if you hit any obstacles with them or run anything except grass through them. Reel mowers are much more difficult to sharpen than other mowers. In addition to sharpening, they have to be back-lapped to achieve the close tolerances required.

The primary safety issue with reel mowers is avoiding contact with the moving blades.

Mower – rotary cutter A rear-mounted rotary cutter (Figure 29) is often referred to as a Bush Hog⁷ - equivalent to referring to all soft drinks as Cokes. These mowers have a single blade (in the sizes used on compact tractors) and are designed for heavy, rough cutting. They are not designed to mow grass as short as is common for lawns and should not be set to cut lower than about 3 inches. They will cut light brush (1 to 2 inches in diameter, depending on model). They are not highly maneuverable because of their length. Cutting height is adjusted by moving both the rear gage wheel and the 3-point hitch on 3-point hitch models. Pull-type models with two wheels are available but less common. Both types are easily attached and removed. Widths of 4 to 6 feet are common with compact tractors.



Figure 29. Rotary cutter for compact tractor.

The most common error with the use of rotary cutters is cutting too low. Rotary cutters are not designed to be finish mowers. If you want to cut turfgrass 2 inches high, you should use a lawn mower or a finishing mower (also called a grooming mower). Since a 3-point hitch rotary cutter typically has a wide deck with only one large blade and only one gage wheel, it cannot follow ground contours and is prone to scalping if run too low. To achieve the desired cutting height on a typical 3-point hitch mounted rotary cutter, you must do two things. First, you must adjust the rear gage wheel to position the blade at the desired height, and then you must set the 3-point hitch control to hold the front of the mower deck at the correct height. You should make

these adjustments with the tractor and mower parked on solid, level ground – preferably pavement. The gage wheel may have a slide adjustment, a series of holes for adjustment or a stack of bushings that are moved above or below the collar. Set the deck approximately level with the 3-point hitch, measure the height from the ground to the cutting edge of the blade at the rear (*with the tractor turned off*) and then adjust as needed to obtain a cutting height of at least 3 inches.

The deck should not be run level. With any rotary mower, it is desirable to set the front slightly lower ($\frac{1}{4}$ to $\frac{1}{2}$ inch on a 4- to 6-foot rotary cutter) so that the blade cuts at the front, and the rear of the blade does not recut the grass or drag on the grass. This will reduce the power requirement and provide a cleaner cut. After you have set the cutting height at the rear using the gage wheel, you will need to adjust the 3-point hitch so that the cutting edge of the blade at the front is $\frac{1}{4}$ to $\frac{1}{2}$ inch lower than at the rear. If your tractor has an adjustable stop on the 3-point hitch control, you should set it at this point. If the tractor has a marked scale on the 3-point hitch control, note and remember the setting. If your tractor has neither, just take a pen or marker and make a small mark at the correct setting so you can come back to it again after you raise or lower the mower.

When running a rotary cutter, the sway bars or chains on the 3-point hitch of the tractor should be reasonably tight to assure that the mower follows straight behind the tractor and doesn't sway. This is especially important when you have to back up.

A rotary cutter must be able to pivot vertically about the lower link pins of the 3-point hitch to allow the mower deck to flex up when the rear of the tractor goes into a depression and flex down when the rear of the tractor goes over a bump, yet must also have a limit on this flexing motion to allow the mower to be raised for transport. All rotary cutters use some type of moving linkage on the upper hitch point to allow this, but improper adjustment can negate it. You must adjust the upper link of the 3-point hitch on your tractor to allow some flex of the mower deck, but still be able to lift the mower. This adjustment is somewhat subjective, but you should adjust the length of the upper link out enough that when you lift the 3-point hitch above the normal operating point, the gage wheel remains on the ground for a while as the front of the mower lifts, but the gage wheel eventually lifts at least a foot off the ground when the 3-point hitch is completely raised.

A rotary cutter must also be level from side to side. The easiest way to check this is to bend down behind the deck (with the PTO disengaged) and sight over the deck at the tractor rear axle. If the deck is not parallel with the tractor axle, you will need to adjust one of the lower 3-point hitch lift arms until it is parallel.

All of these steps are simple to do and take only a few minutes, but they contribute significantly to both the quality of cut and the longevity of your mower.

All rotary cutters are inherently dangerous. Reputable manufacturers do all they can to reduce the risks associated with rotary cutters, but the ultimate safety responsibility rests with the operator. Hazards with rotary cutters include thrown objects, direct blade contact and PTO entanglement.

Of all the hazards inherent in a rotary cutter, the hazard of thrown objects is perhaps least recognized by operators and bystanders. The blades on a rotary cutter may have a tip speed of more than 150 mph. Objects such as stones, cans, bottles (or fragments), pieces of limbs or roots and other debris can be thrown more than 300 feet. Too many people assume that a rotary cutter will not throw objects very far, but testing and documented accidents have demonstrated that objects can be thrown farther than the length of a football field – and still have enough velocity and momentum to cause serious injury. Objects thrown from a rotary cutter can injure you in several ways. Sharp objects can cause severe puncture wounds. Heavy objects can strike the head or body, causing concussion or death. The most common injury, however, is eye damage. Even small objects can injure an eye and cause blindness.

A properly designed and equipped rotary cutter can reduce the risk of injury. The cutter deck should be designed to conform to American Society of Agricultural Engineers Standard S474.1 – Agricultural Rotary Mower Safety. This standard prescribes several safety features for rotary cutters and also contains a procedure for testing rotary cutters for thrown objects using nails dropped through tubes inserted in the deck. Conforming to this standard means that the manufacturer has designed the machine to conform to the state of the art in thrown objects reduction. Nevertheless, the standard does not require or imply total elimination of thrown objects, just a significant reduction in the incidence of thrown objects. Chain guards on the front and rear of the mower can reduce the thrown objects hazard even more, but they will not eliminate the hazard. Chain guards will typically reduce the number of thrown objects by half and significantly reduce the velocity of those that are thrown. Other shielding such as rubber belting or metal bands are used on some machines, but may interfere with mowing efficacy. Most manufacturers offer chain guards; some make them standard equipment, but with a delete option. The cost of chain guards varies with the size of cutter and with the manufacturer. The cost of chain guards may range from under \$100 on small economy machines to well over \$500 on larger heavy-duty cutters.

As an equipment operator, you must be aware of the hazards inherent in thrown objects and take steps to minimize the danger. The first and most important step

is to operate a rotary cutter only if there are no people or animals within 300 feet (or more). If anyone approaches within that range, you should immediately turn off the tractor PTO to stop the cutter and not resume operation until the site is clear of bystanders. Using chain guards is also recommended. It is imperative to use chain guards if you will be working in an area where bystanders might approach within 300 feet. Operating without chain guards is acceptable only in situations where there is no possibility of another person within 300 feet.

Bystanders also have an obligation to stay away from rotary cutters. Although rotary cutters are typically noisy and are visibly dangerous, you should warn family members or anyone else who might approach of the dangers and tell them to stay back at least 300 feet. If a person must approach within several hundred feet of a rotary cutter, he should wear safety glasses. The most dangerous area is the rear of the machine.

The thrown object hazard with rotary cutters is not fully recognized by everyone. It is a very real hazard that can cause injury, blindness or even death. You should buy and use a safe rotary cutter and never operate if anyone gets within 300 feet (or more) of the machine.

Mower – sicklebar Sicklebar mowers (Figure 30) are no longer common, but they have some advantages. They are useful for reaching down into ditches or up onto a slope while the tractor remains level. They will cut tall material without plugging. They require little power. They do not cut or shred the cut material, so the full-length clippings will be left lying on the ground. Although sicklebar mowers usually incorporate a safety break-away, they are susceptible to damage if you run them into obstacles.

The primary safety hazards with sicklebar mowers are sicklebar contact and entrapment in the powertrain. Although these mowers tend to be safer than rotary cutters, care in operation is still required.



Figure 30. Sicklebar mower on small offset tractor.



Figure 31. Pallet forks to fit front-end loader on compact tractor. (Photo from Sweepster FFC)

Pallet forks There are several ways to handle pallets with a compact tractor. The most common way is with a pallet fork attachment (Figure 31) to replace the bucket on a front-end loader. Maneuvering forks in this configuration is more awkward than with a dedicated fork lift,

but it is still a reasonably handy way to pick up and move pallets. Loaders on small compact tractors will not be able to lift heavy pallets. Counterweight on the rear of the tractor will be needed to pick up and move a pallet safely.

A faster and easier way of adding forks to a front-end loader is to mount the forks to the front of the bucket. There are kits that consist of hooks that mount to the top of the bucket. The forks are attached to a heavy steel bar across the tops of the forks. The driver just drives up to the forks, tilts the bucket so that the hooks grab the forks, then tilts it back and is ready to go. Some systems reverse the attachment method and put the bar on the bucket and the hooks on the forks. This system is easy to hitch to but has two major drawbacks: because it fits out in front of the bucket, it moves the load even further forward and reduces load capacity, and it is often impossible to see the forks because of the bucket. This makes it difficult to pick up a pallet.

Fork lift attachments are also available for the rear of the tractor. Some mount to the 3-point hitch and are similar to hay forks; others are on wheels and pull behind the tractor. The 3-point hitch units can carry the heaviest load (for a given tractor size) of any tractor-mounted type. They are reasonably easy to maneuver, relatively inexpensive and easy to attach. They allow you to move pallets, but not lift or stack them.

The primary safety issues with pallet forks are avoiding overloads and overturns. Do not pick up more than your tractor is rated to handle. Be sure to keep the load low. Don't lift a pallet high when on rough ground. If using pallet forks on a front-end loader, be careful to keep the forks level as you lift.

Plastic mulch layer The use of plastic mulch is a common practice for nearly all strawberry growers, many vegetable growers and some home gardeners. Plastic mulch may be used with a fumigant and drip irrigation. Plastic mulch layers (Figure 32) that mount on compact tractors are available to mechanize these operations.



Figure 32. Plastic mulch layer on compact tractor.

Preparation for laying mulch starts well before the mulch is installed. Beds must be formed with a disk bedder or middlebuster. The beds must be firmed and shaped, either before the mulch laying operation or as part of the operation. It is important that both the top and sides of the beds be firm, and there should be no depressions on the bed top to hold water on the mulch. Some growers install the plastic drip tape before laying the mulch, but it is more commonly done simulta-

neously with the mulch laying. It is important to cover over the drip tubing furrow completely to avoid a depression on the bed top.

It is usually best to apply the fumigant with the mulch layer so that the fumigant is immediately sealed before it can vaporize. Occasionally a grower will use two tractors, one knifing in the fumigant and the second tractor immediately behind laying mulch. This procedure risks not getting the fumigant sealed promptly and also exposes the driver of the second tractor and the worker on the mulch layer to more fumigant. As with the drip irrigation knives, it is important that the furrows in the bed from the fumigant knives be closed. Many mulch layers have either compression panels on the sides or a complete bed shaper pan to squeeze the bed and seal the furrows ahead of the plastic mulch. Some inexpensive mulch layers do not have this and merely rely on having a firm bed ahead of the mulch layer.

Adjusting a mulch layer is somewhat of an art. The shaping components of the mulch layer (if so equipped) must be adjusted in both dimensions to deliver a firm bed to the mulch area. There is usually some means of cutting a small trench or furrow at the bottom of the bed sides to receive the sides of the plastic sheet. Rubber tires, frequently smooth, are run on top of the sides of the plastic at a small angle to hold the plastic down and stretch it over the bed. Single disks (or sometimes shovels) on each side are then used to throw soil over the sides of the plastic in the furrow – referred to as the cup. This soil is what holds the plastic mulch in place. Adjusting the tires and covering disks is probably the most critical part of the process. It is also important to maintain the proper fore-and-aft angle on the mulch layer for all of the components to function properly. Some high-end mulch layers have four gage wheels to help with this.

Aside from the usual mechanical safety considerations, chemical safety is a major issue since most fumigants are highly toxic. Care must be taken to be sure workers are not exposed to excessive amounts of fumigant. All workers should wear the personal protective equipment mandated by EPA on the fumigant label. Careful operation can help reduce the problem. For instance, not turning on the fumigant until the knives are in the soil and then turning it off before the knives are raised will help a great deal. Installing a solenoid or motor valve down near the knives will reduce the amount of excess fumigant that drains out at the field ends.

Commercially available mulch layers range from simple light-duty machines to heavy, rigid implements with a corresponding range of prices. The light-duty mulch layers can work satisfactorily if properly adjusted and used, but keeping them in adjustment is much more difficult. The heavy-duty machines tend to be more

reliable and cause less trouble – but require a larger tractor and are more expensive.

Laying plastic mulch along with the accompanying drip tube and fumigant is a major expense and technical challenge for most commercial growers and gardeners. Properly adjusting and using a good mulch layer can minimize problems. For most small growers and gardeners, a good custom operator is often the best solution.

Plastic mulch lifter The use of plastic mulch is a common practice for strawberry and vegetable growers and for some home gardeners, but there are two major problems with plastic mulch: it is expensive to install and at some point it has to be removed from the field. Several machines can help simplify the removal of the mulch (Figure 33).



Figure 33. Plastic mulch lifter on compact tractor.

The traditional method of removing plastic mulch was to first loosen the mulch from the “cup” on each side of the bed by passing a cultivator sweep under the cup and then pick up the mulch by hand. Picking up mulch by hand is a filthy, strenuous task.

Several companies now offer mulch lifters that do a better job of loosening the plastic mulch than a simple sweep. These lifters typically have coulters that run beside the beds to cut any weeds or plant residue and loosen the soil, followed by one-sided blades that run under the cup and under much of the bed to further loosen the soil and lift the plastic mulch. Guides on the back of the blades lift the plastic in the air to allow the loosened soil to fall off. Some of the soil tends to fall back onto the center of the plastic sheet, thus making the plastic difficult to pick up. A coulters running down the center of the bed slices the plastic strip in half, allowing the soil on the center of the plastic to fall through when the plastic is picked up later.

After the plastic is loosened and lifted, some growers pick up the plastic by hand; however, there are several machines that can pick up the plastic. The most common design has a powered spool to roll up the plastic. In most cases, a worker has to tie the strip of plastic to the spool at the beginning of the row and then the plastic can be rolled up. A major problem with this type of pickup device is that as the spool fills, its diameter increases and thus the peripheral speed of the plastic increases. As the spool fills, either the tractor ground speed must constantly increase or the spool rotational speed must constantly decrease. This problem is addressed in different ways on different models of mulch collectors.

Some use a belt drive to the spool and allow the belt to slip to maintain constant tension on the plastic. Others have a variable-speed valve in the hydraulic line to the spool motor that must be manually adjusted (constantly) by an operator riding on the machine. A design developed by the LSU AgCenter (Figure 34) senses the tension on the plastic and automatically adjusts spool speed to provide relatively uniform torque loading on the spool. An entirely different design uses rollers to feed the plastic sheet into a big wire cage instead of rolling it up.



Figure 34. Plastic mulch collector on compact tractor.

It is possible to combine a lifter and collector into a one-pass machine. Although this seems efficient, it is not necessarily desirable, at least in humid climates like Louisiana. Collecting the mulch is much easier when the loosened soil on top of the mulch is completely dry and doesn't stick to the plastic mulch. In the humid South, it is unusual for the soil in the cup to be that dry. It is helpful to run the lifter when the soil is reasonably dry, then allow the loosened soil on top of the mulch to dry further before attempting to pick up the plastic.

Removal of plant residue from the mulch before attempting to lift the mulch will make the operation much more efficient and will reduce the volume and weight of the collected product. A rotary cutter or other mower run as low as possible (without cutting the mulch) before lifting will help.

By far the most common problem in lifting and removing plastic mulch is tearing of the plastic. If the plastic holds together and comes off in one long strip, the task is easy, but in too many cases the plastic tears into small pieces that have to be picked up individually. Removing plant residue, proper lifting and careful collecting will help, but in some cases the plastic is just too weak or brittle and tears too easily. When that happens, picking up the pieces by hand is about the only option.

Removal of plastic mulch continues to be a problem for strawberry and vegetable growers and home gardeners. There are some machines that help with the process. Under ideal conditions, the process can be mechanized, but problems remain, primarily because of tearing of the plastic.

Plow – moldboard The traditional implement for primary tillage is the moldboard plow (Figure 35). A moldboard plow is an effective tillage tool that slices one side and the bottom of a strip of soil and inverts that slice into the adjacent furrow from the previous soil strip. While inverting the soil strip, the curved shape of

the plow bottom twists and fractures the soil, leaving it loose and friable (if the moisture is right). Surface vegetation is buried and the inverted soil is broken up somewhat. In most soils, compact tractors will be able to handle only one or two bottoms, although draft depends on soil type and depth as well as width of the plow bottom(s). A moldboard plow on a compact tractor is useful primarily for home gardens and market gardens.

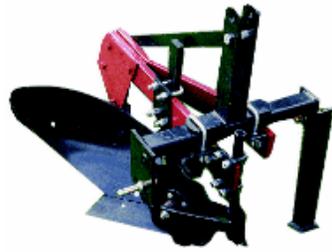


Figure 35. Moldboard plow for primary tillage. (Photo from Howse Implement Co.)

Since moldboard plows have not been popular in the South for many years, few people know how to adjust or use one correctly. For a small moldboard plow to work correctly, the right tires on the tractor must be set the correct distance from the tractor centerline so that the tires run in the previous furrow. The plow operator's manual should give this specification. The plow must then be leveled correctly from front to rear, and adjusted from side to side so that the plow frame is level when the tractor is running in the previous furrow.

A coulter ahead of the moldboard is often necessary to slice the sod or other surface vegetation ahead of the moldboard. It should be adjusted to run about 3/4 inch to the left of the side of the plow. It is also necessary to set the tail wheel properly to hold the plow in place. Some plows have other accessories like trash boards to help invert taller sod.

A correctly plowed field is beautiful and forms the basis for a good seedbed, but moldboard plowing seems to be a dying art. Problems with moldboard plowing include soil compaction by the plow and lack of residue on the surface, leaving the surface prone to erosion.

Post hole digger Digging post holes is a common job for compact tractors. Many companies make post hole diggers that mount on the 3-point hitch of a compact tractor (Figure 36). They are powered by the tractor's PTO. Rural homeowners use post hole diggers for setting fence posts, and landscape contractors use them for both fence posts and for planting trees and shrubs. Augers are usually sold separately from the digger head and are available in sizes from 4 inches to 12 inches. Augers for tree planting are available in sizes to 30 inches, but the larger sizes are usually intended for larger tractors.



Figure 36. Post hole digger for use on compact tractor. (Photo from Danuser)

Post hole diggers work well in some soils but may have trouble

penetrating hard soils. Although post hole diggers are often used to dig planting holes for trees and shrubs, the augers have a tendency to "slick" and compact the soil on the sides of the hole, limiting root growth.

If an auger encounters roots or other obstacles in the soil, they can be forced down rapidly and may break a shear pin. Both the PTO shaft and the auger can cause serious injury if a person becomes entangled. Do not wear loose clothing around an auger; keep people away from the machine while in operation.

Rake – landscape A useful tool for landscape contractors is a landscape rake (Figure 37). These rakes are used primarily for preparing ground for seeding or sodding of turfgrass. They break up soft clods and can rake away hard clods. They lightly scratch the soil surface and leave just enough surface roughness to provide a good basis for seeding. Many landscape rakes are designed to allow them to be angled to the side – helpful in removing and windrowing rocks, trash or hard clods. A landscape rake should not be used to rake leaves, clippings or pine straw from turf. It is too aggressive and will damage the turf.



Figure 37. Landscape rake on compact tractor. (Photo from Deere and Company)

Rake – lawn and pine straw Most lawns need to be raked at one time or another to remove clippings or to collect leaves or pine needles. Pine straw (dead pine needles) is a valuable resource in the Deep South. An excellent mulch, it is much in demand for landscaping. Commercial operators bale pine straw and sell it to contractors and garden centers who in turn sell it to homeowners. If you own some land with pine trees, you can easily rake your own pine straw.

If you have a limited area of lawn or pine straw to rake, you can use a garden rake or a leaf rake. If you have a larger area or want to collect a considerable quantity of pine straw, a small tractor rake will save a tremendous amount of work. Many commercial operators use an old dump rake for pine straw. This has the advantage of allowing the driver to back and maneuver among trees, but it tends to tear out grass and may even act like a harrow and tear up the sod and soil. Dump rakes are scarce and hard to find now. Many companies make 3-point hitch landscape rakes with strong spring teeth. The teeth on these landscape rakes tend to be too aggressive for lawns and raking pine straw; they will do even more damage to the soil than the old dump rakes. Another option is a small landscape wheel rake (Figure 38). These rakes are sold for use on lawns – raking

leaves, grass clippings and pine straw. They do an excellent job of windrowing pine straw and, if properly adjusted, will not damage the grass or gouge the soil. Easy to use, they are available in widths from 4 to 8 feet. They are not popular with commercial operators because they are not as maneuverable as dump rakes nor are they as tough.

A wheel-type pine straw rake can be pulled by a small tractor, a riding mower, a utility vehicle or an ATV. Proper adjustment is essential: too high and you will miss the leaves or pine straw; too low and you will damage the turf and possibly the tines. A hydraulic cylinder for easy adjustment is an option, but for a machine that has limited use, the standard screw adjustment is usually adequate. A major concern when raking pine straw is to avoid hitting the trees with the rake. Since pine straw is found only under pine trees, you will be constantly dodging trees. Sideswiping a tree can bend the rake tines.

The rake will leave a neat windrow of leaves or pine straw. Normally, a homeowner will just pick it up by hand (using a leaf or garden rake) and haul it to wherever it is needed using a garden cart, utility vehicle or carrying it by hand. Most farm hay balers are far too big, heavy and expensive for occasional use on a homestead. A few companies make small balers aimed at the pine straw market, but even they are pricey for a homeowner.

If you have a large lawn or if you rake up and use a lot of pine straw on your place, you might want to look into the use of a wheeled lawn rake.

Rotary tiller Compact tractors can handle small rotary tillers (Figure 39). These tillers are useful in landscape installation and for gardens and small farms. Rotary tillers can be used for primary or secondary tillage. They are especially well suited to once-over tillage and are capable of going from a vegetated surface to a tilled seedbed in one pass (under ideal conditions).

The widths available in rotary tillers for compact tractors run from about 3 to 5 feet. Since rotary tillers typically require 10-15 hp per foot of width if operated at full depth and normal operating speed, a compact tractor cannot handle a large tiller. Some smaller compact tractors are not capable of handling a tiller that



Figure 38. Rake for lawns and pine straw on compact tractor.



Figure 39. Heavy-duty rotary tiller on compact tractor.

matches the full width of the tractor, thus the tiller must be offset to one side and will thus till up wheel tracks on only one side. Some tillers have a fixed offset; others can be shifted to the side or centered.

Most rotary tillers have a hinged flap on the back that can be fastened up out of the way or allowed to drag and smooth or level the soil behind the tiller. Rotary tillers are powered by the PTO to a gearbox and the tiller shaft is then driven by either gears or a heavy chain. Less expensive models use a chain; higher quality models use gears. It is important to maintain the proper oil level in the gear case or chain case. The PTO shaft universal joints and any other grease fittings should also be lubricated as recommended by the manufacturer.

Rotary tillers can be run from an inch or two deep down to 8-9 inches on some models. Tilling quality is affected by ground speed. The faster the tiller is moved, the fewer cuts per foot and the coarser the tillage. By slowing down (perhaps as slow as one mph), an operator can achieve very fine tillage of soil. In some cases, a rotary tiller can do too much tillage and destroy soil structure. After a heavy rain, some rotary-tilled soils will “melt” together into a solid mass with no structure or soil aeration. If a tiller is operated too fast, it will “walk” across the surface instead of digging.

Rotary tillers can be used for cultivation, but using them in this manner requires a wide spacing between crop rows. Vegetable growers can use a rotary tiller to maintain the middles between wide-spaced rows of tomatoes, eggplant and similar crops. For most gardens, a walk-behind tiller is much more practical for cultivation.

Safety issues for rotary tillers primarily involve contact with rotating parts (PTO shaft, cross shaft and tine shaft/tines). It is possible for a tiller to throw objects with considerable force, so safety glasses are needed for the operator and any bystanders. Do not engage the PTO if anyone is near the tiller.

Sprayer Spraying pesticides is a common job for compact tractors. The most common type of sprayer is a boom sprayer mounted on the 3-point hitch (Figure 40) although trailer sprayers (Figure 41) are available, too.

Most of these sprayers are very simple. They normally use a spray pump mounted to the tractor PTO. Roller pumps are common on less expensive units, although centrifugal pumps also are used. Roller pumps can develop higher pressure. Centrifugal pumps are limited to around 60 psig, but they can deliver much



Figure 40. Sprayer for 3-point hitch on compact tractor. (Photo from AgSpray Equipment Company)

higher volume – an advantage for fluid agitation. Simple pressure regulation, bypass and/or jet agitation, and a flow control valve complete the plumbing.

Most of these small sprayers have a boom with multiple nozzles for relatively uniform broadcast spraying. They can be used for applying herbicides, fungicides, insecticides and even liquid fertilizers to turfgrass or to other crops.

Sprayers are easily customized for a specific need by changing nozzles, pumps, nozzle spacing, boom height, type of agitation, etc. Most of the commercially available sprayers are made by small companies using off-the-shelf components.

Sprayers have several safety issues – primarily dealing with the nature of pesticides and fertilizers. Spray drift into non-target areas is a serious potential problem as is overapplication. Calibration is critical to obtain the correct rate and minimize problems. Information on calibration is available on the LSU AgCenter Web site (www.lsuagcenter.com). Appropriate protective gear should be worn when mixing, calibrating or spraying. This personal protective equipment (PPE) is specified on the product label.

Spreader Both rotary and pendulum-action spreaders (Figure 42) are available for 3-point hitch mounting on compact tractors. Many of the inexpensive rotary spreaders are of poor quality and will not yield a uniform distribution pattern. All rotary spreaders require the operator to adjust the pattern setting(s) for each product. Even when the pattern settings are optimized, the patterns will be non-symmetrical in most cases. A series of pattern tests is necessary to determine the optimum pattern settings and the effective swath width. Some products, particularly turfgrass products, will provide pattern setting and width recommendations on the bag labels. Settings are seldom available for ag-grade fertilizers.

Pendulum-action spreaders should give a symmetrical pattern with all products without the need for any pattern adjustment. It is still necessary to determine the effective swath width, either by testing or from the bag label. Pendulum spreaders can also be used for



Figure 41. Trailer sprayer for compact tractor. (Photo from Century)



Figure 42. Pendulum-action spreader on compact tractor.

banding fertilizer. With a shortened spout, they can throw two bands on opposite sides of the tractor with the spacing between bands determined by spout length, PTO speed and spout height. If the spout is removed and a splitter box mounted, they can drop bands of fertilizer for sidedressing row crops.

With either type of spreader, the rate setting must be determined by calibration. Even if the product label provides a setting, this should be used only as a starting point for calibration.

More information on calibrating and using spreaders is found on the LSU AgCenter Web site (www.lsuagcenter.com) and in LSU AgCenter Research Bulletin #866, Granular Spreaders: Selection, Calibration, Testing, and Use. This bulletin is available from county agents.

Stump grinder A few companies manufacture stump grinders that mount on a tractor 3-point hitch and are powered by the tractor's PTO (Figure 43). These stump grinders are not as versatile as dedicated stump grinders, but they are much less expensive and are adequate for occasional use by a contractor, farmer or rural homeowner. They require a compact tractor with at least one remote hydraulic outlet, and some require two hydraulic outlets.



Figure 43. Stump grinder mounted on compact tractor. (Photo from Wikco)

Stump grinders use a wheel with carbide-tipped teeth to grind up stumps and roots. The wheel cuts as it is swung from side to side and lowered and/or moved into the stump before each swing. Tractor stump grinders rely on the tractor hitch or a hydraulic cylinder for height adjustment and use a hydraulic cylinder to swing the cutting wheel. The tractor has to be backed up to advance the wheel into the stump for the next cut. It is important to limit the amount of wood cut per swing. Lowering the wheel too much or backing too far into the stump will overload the wheel.

Stumps are often ground down several inches below the soil surface so soil can be backfilled over the stump. This will entail grinding surface roots as well as the stump.

Stump cutters are extremely aggressive machines. The cutting wheel can easily remove a foot or leg. Allow no bystanders in the area when cutting. Never leave the tractor seat with the PTO engaged, and wait for the wheel to stop turning before approaching the rear of the tractor. Thrown objects are a serious hazard also. The operator should wear safety glasses or goggles and hearing protection.

Subsoiler For breaking compacted subsoil, a subsoiler shank (Figure 44) is the tool of choice. The power requirement for a subsoiler is high, so only the larger compact tractors will be able to handle a subsoiler, and even they will be limited to one shank if the subsoiler is run at normal depth. Subsoilers are typically run from 12-20 inches deep. The purpose of a subsoiler is to break up a compacted hardpan in the subsoil. To shatter a hardpan effectively, you must work with reasonably dry soil. If a subsoiler is run in wet soil, the soil will just flow around the subsoiler.

Straight shank subsoilers (Figure 44) are most common for compact tractor use since they are the least expensive, but curved (parabolic) subsoiler shanks require less power for a given depth.

Most subsoilers have some type of “foot” at the bottom to aid in shattering the soil. The most effective type depends on soil conditions.

All subsoilers need some type of trip mechanism to allow the subsoiler to swing back if it encounters a stump, rock, root, etc. On most small units, a shear bolt is used.

If subsoiling a field intended for row crops, it is usually most effective to subsoil directly under the row location. This will provide an open path for crop roots to grow through the compacted hardpan.

For additional information on compact tractors Additional information on compact tractors is available in LSU AgCenter Extension Bulletin #2906, Compact Tractor Selection, Use and Safety. It is available on the LSU AgCenter Web site (www.lsuagcenter.com).



*Figure 44.
Subsoiler for
compact tractor.
(Photo from
Howse Implement
Company)*

Author:

Richard L. Parish, Ph.D.
Hammond Research Station

Louisiana State University Agricultural Center

William B. Richardson, Chancellor

Louisiana Agricultural Experiment Station

David J. Boethel, Vice Chancellor and Director

Louisiana Cooperative Extension Service

Paul D. Coreil, Vice Chancellor and Director

Pub. 2917 (Online Only) 5/05

Issued in furtherance of Cooperative Extension work, Acts of Congress of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. The Louisiana Cooperative Extension Service provides equal opportunities in programs and employment.